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ABSTRACT

This paper examines relationships between teachers and students. Data was gathered through administration of the 48-item version of the Questionnaire on Teacher Interaction (QTI). At least 20 secondary science classes in three countries responded to the QTI indicating their perceptions of their science teachers' interpersonal behavior. Cross validation data is provided on the use of the QTI in the United States, Singapore, and Australia. Comparisons are made between the students' perceptions in each country. (Contains 25 references.) (DDR)

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A Comparison of Teacher-Student Interpersonal Behavior In Secondary Science Classes in USA, Singapore & Australia

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ABSTRACT

This paper examines relationships between teachers and students. Data were gathered through administration of the 48-item version of the Questionnaire on Teacher Interaction (QTI). At least twenty secondary science classes in each of USA, Singapore and Australia provided the sample of science students. Students responded to the QTI indicating their perceptions of their science teachers' interpersonal behavior. Cross validation data are provided on the use of the QTI in the three countries. Comparisons are made between the students' perceptions in each country.

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Introduction

This paper describes the use of the 48-item version *Questionnaire on Teacher Interaction (QTI)* in secondary school science classes in secondary science classes in each of USA, Singapore and Australia and reports validation data on its use. Students responded to the QTI indicating their perceptions of their science teachers' interpersonal behaviors.

The Questionnaire on Teacher Interaction

International research efforts involving the conceptualisation, assessment and investigation of perceptions of psychosocial aspects of the classroom environment have firmly established classroom environment as a thriving field of study (Fraser, 1994; Fraser, & Walberg, 1991). Recent classroom environment research has focused on science laboratory classroom environments (McRobbie & Fraser, 1993), constructivist classroom environments (Taylor, Fraser & Fisher, 1997) and computer-assisted instruction classrooms (Teh & Fraser, 1994; Fisher & Stolarchuk, 1997; Newby & Fisher, 1997).

A team of researchers in The Netherlands extended this research by focusing specifically on the interpersonal relationships between teachers and their students as assessed by the QTI (Wubbels, Créton, & Hoomayers, 1992; Wubbels & Levy, 1993). The Dutch researchers (Wubbels, Créton, & Holvast, 1988) investigated teacher behavior in a classroom from a systems perspective, adapting a theory on communications processes developed by Waltzlawick, Beavin, and Jackson (1967). Within the systems perspective of communication, it is assumed that the behaviors of participants mutually influence each other. The behavior of the teacher is influenced by the behavior of the students and in turn influences the student behavior. Thus, a circular communication process develops which not only consists of behavior, but determines behavior as well.

With the systems perspective in mind, Wubbels, Créton and Hooymayers (1985) developed a model to map interpersonal teacher behavior using an adaptation of the work of Leary (1957). In the adaptation of the Leary model, teacher behavior is mapped with a Proximity dimension (Cooperation, C - Opposition, O) and an Influence dimension (Dominance, D, - Submission, S) to form eight sectors, each describing different behavior aspects: Leadership, Helping/Friendly, Understanding, Student Responsibility and Freedom, Uncertain, Dissatisfied, Admonishing and Strict behavior. Figure 1 shows typical behaviors for each sector. The Questionnaire on Teacher Interaction (QTI) is based on this model.

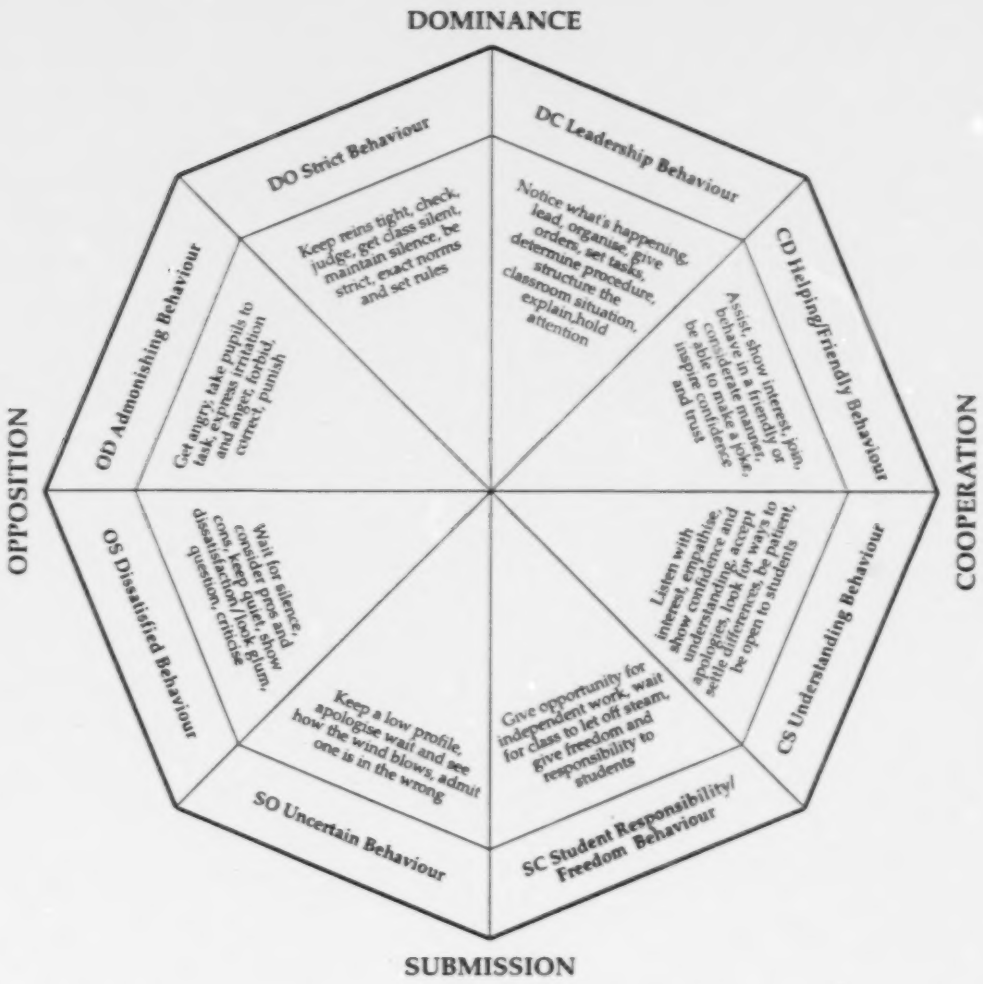
DOMINANCE
DO Strict Behaviour
DC Leadership Behaviour
CD Helping/Friendly Behaviour
COOPERATION
CS Understanding Behaviour
SC Student Responsibility/ Freedom Behaviour
SUBMISSION
SO Uncertain Behaviour
OS Dissatisfied Behaviour
OPPOSITION
OD Admonishing Behaviour
Keep reins tight, check, judge, get class silent, maintain silence, be strict, exact norms and set rules
Notice what's happening, lead, organise, give orders, set tasks, determine procedure, structure the classroom situation, explain,hold attention
Assist, show interest, joan, behave in a friendly or considerate manner, be able to make a joke, inspire confidence and trust
Listen with interest, empathise, show confidence and understanding, accept apologies, look for ways to settle differences, be patient, be open to students
Give opportunity for independent work, wait for class to let off steam, give freedom and responsibility to students
Keep a low profile, apologise wait and see how the wind blows, admit one is in the wrong
Wait for silence, consider pros and cons, keep quiet, show dissatisfaction/look glum, question, criticise
Get angry, take pupils to task, express irritation and anger, forbid, correct, punish

Figure 1. The model for interpersonal teacher behavior

The items of the QTI belong to eight scales, each consisting of six items and corresponding to one of the eight sections in the model. Examples of items are "This teacher is friendly"(Helping/Friendly) and "This teacher gets angry unexpectedly"(Admonishing). The scores for each item within the same sector are added to obtain a total scale score. The higher the scale score the more a teacher is perceived to exhibit behaviors from that sector. Scale scores can be obtained for individual students, or can be combined to form the mean of all students in a class.

The original version of the QTI developed in the early 1980s in The Netherlands had 77 items (Wubbels, Créton, & Hooymayers, 1985). Later, an American version of the QTI

was developed which had 64 items (Wubbels & Levy, 1991). The Australian version of the QTI described in this paper, is more economical and has 48 items which are answered using a five-point Likert response scale. Table 1 presents a description and a sample item of each scale of the QTI.

Table 1
Description of Scales and Sample Items for each Scale of the QTI

Scale Name	Description of Scale (The extent to which the teacher...)	Sample Item
Leadership	...leads, organises, gives orders, determines procedure and structures the classroom situation.	This teacher talks enthusiastically about his/her subject.
Helping/Friendly	...shows interest, behaves in a friendly or considerate manner and inspires confidence and trust.	This teacher helps us with our work.
Understanding	...listens with interest, empathises, shows confidence and understanding and is open with students.	This teacher trusts us.
Student Responsibility/Freedom	...gives opportunity for independent work, gives freedom and responsibility to students.	We can decide some things in this teachers class.
Uncertain	...behaves in an uncertain manner and keeps a low profile.	This teacher seems uncertain.
Dissatisfied	...expresses dissatisfaction, looks unhappy, criticises and waits for silence.	This teacher thinks that we cheat.
Admonishing	...gets angry, express irritation and anger, forbids and punishes.	This teacher gets angry unexpectedly.
Strict	...checks, maintains silence and strictly enforces the rules.	This teacher is strict.

One advantage of the QTI is that it can be used to obtain the perceptions of interpersonal behavior of either students or teachers. When the QTI is administered to both teachers and their students, information is provided about the perceptions of teachers and the perceptions of their students of the interpersonal behavior of that teacher. The information obtained by means of the questionnaire includes perceptions of the behavior of the teacher towards the students as a class, and reflects relatively stable patterns of behavior over a considerable period. Similarly, teachers can be asked for their perceptions of their own behavior or the behavior that they consider to be ideal. The wording of the questionnaire is varied slightly

when used to obtain teachers' self-perceptions and ideals. For example the question "This teacher talks enthusiastically about his/her subject", becomes "I talk enthusiastically about my subject" in the teacher self-perception version, and "The teacher would talk enthusiastically about his/her subject" in the teacher ideal version.

By using these three separate forms of the QTI it is possible to collect data on students' perceptions of teacher-student interpersonal behavior, teachers' perceptions of their actual teacher-student interpersonal behavior in the classroom and what they perceive to be ideal.

Previous use of the QTI

The QTI has been shown to be a valid and reliable instrument when used in The Netherlands (Wubbels & Levy, 1993). When the 64-item USA version of the QTI was used (Wubbels & Levy, 1993) with 1,606 students and 66 teachers in the USA, the cross-cultural validity and usefulness of the QTI were confirmed. It is this data set that has been used in this paper to provide teacher for comparison in Figure 2. Using the Cronbach alpha coefficient, Wubbels and Levy (1991) reported acceptable internal consistency reliabilities for the QTI scales ranging from 0.76 to 0.84 for student responses and from 0.74 to 0. 84 for teacher responses.

Wubbels (1993) used the QTI with a sample of 792 students and 46 teachers in Western Australia and Tasmania. The results of this study were similar to previous Dutch and American research in that, generally, teachers did not reach their ideal and differed from the best teachers as perceived by students. It is noteworthy that the best teachers, according to students, are stronger leaders, more friendly and understanding, and less uncertain, dissatisfied and admonishing than teachers on average.

When teachers described their perceptions of their own behaviors, they tended to see it a little more favourably than did their students. On average, the teachers' perceptions were between the students' perceptions of actual behavior and the teachers' ideal behavior. An interpretation of this is that teachers think that they behave closer to their ideal than their students think that they do.

Another use of the QTI in The Netherlands involved investigation of relationships between perceptions on the QTI scales and student outcomes (Wubbels, Brekelmans, & Hooymayers, 1991). Students' cognitive outcomes were positively associated with teachers that demonstrated greater levels of strict, leadership and helping/friendly behaviors

in their interactions with students. Conversely, when student responsibility and freedom, uncertain and dissatisfied behaviors were high there was a negative association with student achievement.

Variations in the students' appreciation of the subject and the lessons have been characterised on the basis of the proximity dimension: the more cooperative the behavior displayed in the interactions, the higher the affective outcome scores (Wubbels, Brekelmans, & Hooymayers, 1991). That is, student responsibility and freedom, understanding, helping/friendly and leadership behaviors were related positively to student attitudes. Uncertain, dissatisfied, admonishing and strict behaviors were related negatively to student attitudes. Overall, previous studies have indicated that interpersonal teacher behavior is an important aspect of the learning environment and that it is related strongly to student outcomes.

The QTI also has been used to develop typologies of teacher interpersonal behavior in The Netherlands (Wubbels, Brekelmans, Créton, & Hooymayers, 1990). Using cluster analysis, eight types were distinguished. The behavioral patterns on the eight teacher types were characterised as directive, authoritative, tolerant/authoritative, tolerant, uncertain/tolerant, uncertain/aggressive, repressive, and drudging. Teacher types associated with the greatest student cognitive and affective gains were directive (characterised by a well structured task oriented learning environment) and tolerant/authoritative (characterised by a pleasant well structured environment in which the teacher has a good relationship with students). Uncertain/aggressive (characterised by an aggressive kind of disorder) and uncertain/tolerant teacher types were associated with the lowest student gains.

Levy, Créton and Wubbels (1993) analysed data from studies in The Netherlands, the USA and Australia involving students being asked to use the QTI to rate their best and worst teachers. Students rated their best teachers as being strong leaders and as friendly and understanding. The characteristics of the worst teachers were that they were more admonishing and dissatisfied. In a further investigation into the characteristics of teachers, Wubbels and Levy (1991) compared Dutch and American teachers and found very few differences, although American teachers were perceived as stricter and Dutch teachers as giving their students more responsibility and freedom.

In one of the first uses of the QTI in Australia, (Fisher, Fraser & Wubbels, 1993), associations were investigated between teachers' perceptions of their work environment,

using the *School Level Environment Questionnaire (SLEQ)*, and students' and teachers' perceptions of their classroom interactions (Fisher & Fraser, 1990). Results from this study indicated that relationships between SLEQ and QTI scores generally were weak, thus suggesting that teachers believed that they had considerable freedom to shape their own classrooms regardless of their school environment.

A team of researchers in Australia completed the first use of the 48 item QTI in senior biology classes with a sample of 489 students in 28 biology classes (Fisher, Henderson & Fraser, 1995). Although past studies have examined associations between student perceptions of the learning environment mostly in science classes and student outcomes, this Australian study was unique in that it examined student outcomes in three distinct areas – student attitude, achievement in a written examination, and performance on practical tests. This study confirmed the validity and reliability of the QTI when used in senior secondary biology classes. The alpha reliability figures for the different QTI scales ranged from 0.63 to 0.83 when the individual student was used as the unit of analysis and from 0.74 to 0.95 when the class mean was used (Fisher, Henderson & Fraser, 1995). Generally, the dimensions of the QTI were found to be associated significantly with student attitude scores. In particular, students' attitude scores were higher in classrooms in which students perceived greater leadership, helping/friendly, and understanding in their teachers' interpersonal behaviors. Conversely, students' attitude scores were lower in classrooms in which students perceived greater uncertainty, dissatisfaction, admonishing, and strictness in their teachers' interpersonal behaviors. It was concluded that, if biology teachers want to promote favourable student attitudes in their class and laboratory work, they should ensure the presence of these interpersonal behaviors.

Fisher, Fraser, and Rickards (1996) have described how science teachers can use the results obtained with the three versions of the QTI as a basis for reflecting on their own teaching and thus providing a basis for guiding systematic attempts to improve their teaching practice. Fisher, Fraser, and Rickards (1996) also reported that after having completed the questionnaire and having had time to read the QTI report supplied to them, science teachers stated that the results had stimulated them to reflect on their own teaching. The results of the QTI led one teacher to comment on verbal communication in her classroom. Based upon her sector profile diagrams, she concluded that she had become more aware of the students' needs for clear communication. This subsequently became a focus for her in improving her classroom environment and her teaching.

Fisher, Kent, and Fraser (1998) provided a distinctive contribution to learning environment research by investigating the relationship between student and teacher perceptions of teacher-student interpersonal behavior using the QTI and teacher personality using the *Myers-Briggs Type Indicator (MBTI)*. A sample of 108 teachers from eight secondary colleges (Grades 11 and 12) in Tasmania, Australia, completed the MBTI and QTI and the students in one of the classes of each teacher completed the QTI. A greater positive association was found between teacher personality and self perception of student-teacher interpersonal behavior than between teacher personality and their students' perceptions. Teacher personality appeared to be consistently associated with teacher self perception of being friendly, helpful, giving freedom, responsibility and opportunity for independent work in class, uncertainty, maintaining a low profile and being passive.

A primary school adaptation of the QTI was used in Singapore by Goh and Fraser (1996). This revised questionnaire was administered to 1,512 students in 39 fifth-grade classes in Singapore and each scale exhibited satisfactory internal consistency and predictive validity for two levels of analysis (the student and the class mean) and differentiated between classes. Furthermore, girls consistently rated the teacher, behavior more favourably than did boys.

Method

Two research questions were explored in this study. Firstly, is the QTI a valid and reliable questionnaire for use in Australia, Singapore and USA? Secondly, what differences exist in student perceptions of their teachers' interpersonal behavior in Australia, Singapore and USA?

In order to answer these questions, a cross-national sample was required. This sample was composed of 720 students in 20 grades 8 and 9 science classes in Singapore, 705 students in 29 grades 8 and 9 science classes in Australia and 728 students in 33 grade 9 classes in the USA. All students completed the student version of the QTI to describe the teacher-student interpersonal behavior occurring in their classrooms.

Results

Table 2 provides some cross-validation information for the student version of the QTI when used specifically in the present samples of science classes. Statistics are reported for two units of analysis, namely, the student's score and the class mean score. As expected, reliabilities for class mean scores were higher than those where the individual student was used as the unit of analysis.

Table 2 shows that, for Singapore, the alpha reliability figures for different QTI scales ranged from 0.50 to 0.88 when the individual student was used as the unit of analysis, and from 0.60 to 0.98 when the class mean was used as the unit of analysis. For the Australian sample, the corresponding values were 0.60 to 0.88 and 0.64 to 0.96 respectively. The sample from the USA reported values for the individual student ranged from 0.60 to 0.87 and class mean score values were 0.68 to 0.97.

The values presented in Table 2 for the present sample generally provide further cross-validation information supporting the internal consistency of the QTI with either the individual student or the class mean as the unit of analysis. The Student Responsibility/Freedom scale has reliability figures less than the other scales, particularly in Singapore, and this scale requires examination and revision before using the questionnaire in that country.

Another desirable characteristic of any instrument like the QTI is that it is capable of differentiating between the perceptions of students in different classrooms. That is, students within the same class should perceive it relatively similarly, while mean within-class perceptions should vary from class to class. This characteristic was explored for each scale of the QTI using one-way ANOVA, with class membership as the main effect. Table 2 shows that each QTI scale differentiated significantly ($p<0.001$) between classes and that the eta^2 statistic, representing the proportion of variance explained by class membership, ranged from 0.13 to 0.47 for different classes in Singapore, from 0.15 to 0.42 for different classes in the USA and from 0.15 to 0.40 for different classes in Australia.

Table 2
Internal Consistency (Cronbach Alpha Coefficient) and Ability to Differentiate between Classrooms of the QTI for USA, Singapore and Australian Student data Samples

		USA		Singapore		Australia	
Scale	Unit of Analysis	Alpha Reliability	ANOVA Results (eta^2)	Alpha Reliability	ANOVA Results (eta^2)	Alpha Reliability	ANOVA Results (eta^2)
Leadership	Individual	0.85	0.42*	0.81	0.33*	0.83	0.39*
	Class Mean	0.97		0.96		0.93	
Helping/ Friendly	Individual	0.87	0.37*	0.88	0.47*	0.88	0.40*
	Class Mean	0.97		0.97		0.95	
Understanding	Individual	0.84	0.30*	0.82	0.42*	0.87	0.39*
	Class Mean	0.95		0.96		0.96	
Student Resp/ Freedom	Individual	0.69	0.22*	0.50	0.13*	0.60	0.22*
	Class Mean	0.88		0.60		0.79	
Uncertain	Individual	0.77	0.23*	0.66	0.26*	0.73	0.25*
	Class Mean	0.92		0.89		0.86	
Dissatisfied	Individual	0.77	0.15*	0.87	0.52*	0.81	0.21*
	Class Mean	0.87		0.98		0.91	
Admonishing	Individual	0.74	0.24*	0.63	0.45*	0.75	0.25*
	Class Mean	0.87		0.79		0.82	
Strict	Individual	0.60	0.15*	0.64	0.18*	0.63	0.15*
	Class Mean	0.68		0.74		0.64	

*$p<.001$

For USA Sample n = 712 students in 33 classes
For Singaporean Sample n = 720 students in 20 classes
For Australian Sample n = 709 students in 29 classes

Table 3
Scale Means and Standard Deviations for Singapore and Australian Science Students' Scores on the Eight Scales of the QTI

Scale	Scale Mean			Difference	Standard Deviation			F Value
	Singapore	Australia	USA		Singapore	Australia	USA	
Leadership	2.81	2.83	3.04	0.23	0.71	0.77	0.77	21.55*
Helping/ Friendly	2.69	2.84	3.23	0.54	0.88	0.95	0.79	73.61*
Understanding	2.82	2.83	3.19	0.37	0.77	0.90	0.74	47.99*
Student Resp/ Freedom	1.30	1.58	2.02	0.72	0.49	0.61	0.71	250.24*
Uncertain	0.69	0.85	0.87	0.18	0.54	0.71	0.87	13.89*
Dissatisfied	0.96	1.06	0.86	0.20	0.82	0.84	0.76	11.17*
Admonishing	1.20	1.38	1.21	0.18	0.64	0.82	0.80	13.09*
Strict	2.17	1.87	1.67	0.50	0.58	0.66	0.66	114.42*

* $p<.001$

For USA Sample n = 712 students in 33 classes
For Singaporean Sample n = 720 students in 20 classes
For Australian Sample n = 709 students in 29 classes

Country differences in teacher-student interpersonal behavior were examined using a two-way MANOVA with the eight QTI scales as dependent variables. Table 3 presents the scale means and standard deviations for science students' scores on the eight scales of the QTI in Singapore, Australia and USA. The magnitude of these differences is not large, but statistically significant country differences were apparent in students' responses to all eight scales of the QTI, with American students perceiving greater leadership, helping/friendly and understanding behaviors in their teachers and receiving more responsibility and freedom in the classroom. The Australian students perceived their teachers as being more dissatisfied and admonishing. In contrast, Singaporean students perceived their teachers as being stricter.

Conclusions

This study confirmed the reliability and validity of the QTI for use in science classes in Australia, USA and Singapore. The QTI provides science teachers, in any of these three countries, with a basis for autonomous self-reflection that is driven by the needs of the individual teacher. This questionnaire can be administered by the teacher and serves as a valuable tool for science teachers to have in their toolbox of resources for self development. Data gathered from use of the QTI could be used when considering staff development activities in schools by allowing teachers within the school to determine issues related to teacher-student interpersonal behavior that are important to them. Data collected by the QTI can provide individual science teachers with information about their classroom environments from the perspective of the students within their classrooms.

Small differences were found between student perceptions of science teachers in the three countries. The greatest of these was that teachers in the USA were perceived as exhibiting more helping/friendly and understanding behavior and giving more student responsibility and freedom while interacting with students in their classes. The teachers in Singapore were perceived as being stricter than teachers in the USA or Australian student sample.

By making an effort to cross national boundaries with research in science education, new perspectives are able to be explored and questioned. The promise of new insights into commonly held practices, beliefs and attitudes in one country can be exposed, made 'strange' and questioned when researchers from two or more countries collaborate on research involving science teaching and learning. Finally, there is greater variation in the variables of interest (eg, student attitudes or teaching methods) in a sample that is drawn from multiple countries than from a single country sample.

It is useful for teachers and researchers alike to have an instrument such as the QTI that has been shown to be valid and reliable when used in cross cultural studies (Fisher, Wong, Goh, & Rickards, 1996) as this enhances the ability of classroom teachers in one country to make more direct comparisons of their teacher-student interpersonal behavior with teachers in other countries. This global interchange of information can only be enhanced by the publishing in international science education journals and the presenting of research at international conferences such as this.

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